Name: _____ Problems Solved __/ 8

Conceptual questions: (Remember to explain your reasoning)

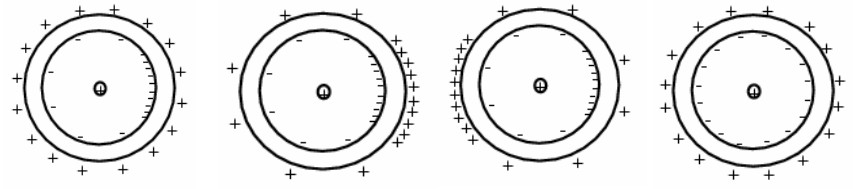
Any excess charge placed on a conductor will:

1) move to the interior of the conductor
2) distribute itself evenly within the conductor
3) move to the exterior surface of the conductor
4) None of the above

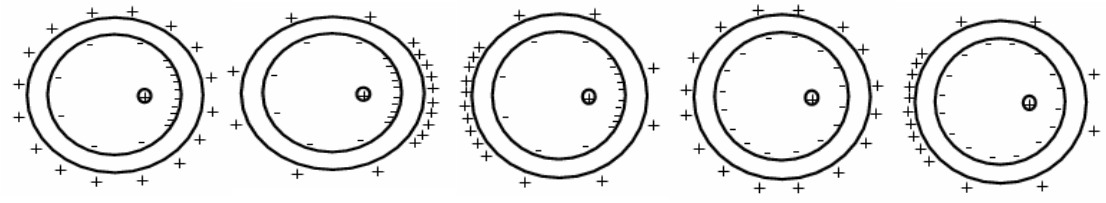
Which of the following is a TRUE statement?

1) The electric field within a conductor in equilibrium is never zero
2) The electric field within a conductor in equilibrium is always zero
3) The electric field within a conductor in equilibrium is sometimes zero
4) None of the above

A positive charge is kept (fixed) at ***the center*** inside a fixed spherical ***neutral*** conducting shell. Which of the following represents the charge distribution on the inner and outer walls of the shell?



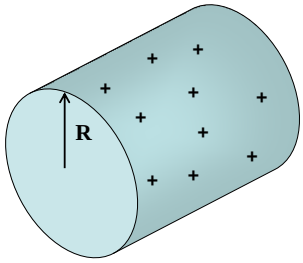
The positive charge is now moved and kept fixed ***off-center*** inside the fixed spherical neutral conducting shell. Which of the following represents the charge distribution on the inner and outer surfaces of the shell?



A 250 nC point charge is placed at the center of an uncharged spherical conducting shell 20 cm in radius.

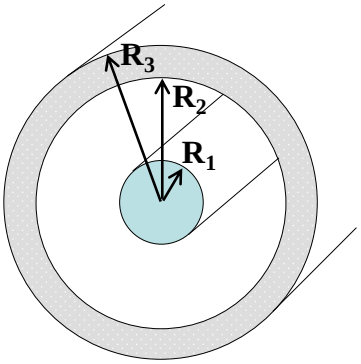
(a) Find the surface charge density on the outer surface of the shell
(b) Find the electric field strength at the shell's outer surface.

Calculate the electric field both inside and outside of an <u>infinitely long</u> cylindrical <u>shell</u> (it's hollow) of radius R and surface charge density σ. Write your answers in terms of the constants k (=$1/4\pi\varepsilon_o$) and σ. After finding the field outside the cylinder, compare your answer to that of an infinite line charge.

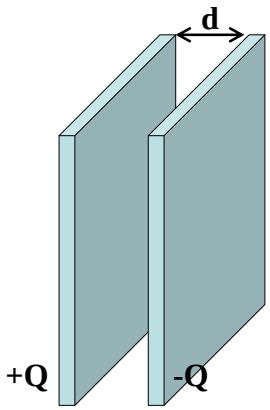


An infinitely long <u>insulating</u> cylinder is surrounded by a hollow <u>conducting</u> cylinder. The solid inner cylinder has a radius of R_1 and a charge per unit <u>length</u> of $+6\lambda$, with the charge uniformly distributed throughout its volume. The outer cylinder has an inner radius of R_2, an outer radius of R_3, and a net charge per unit length of -4λ.

(a) Show how the charge is distributed throughout the system.
(b) Find expressions for the electric field for all values of the radial distance *r*.
(c) Draw a graph of the electric field for all values of *r*.



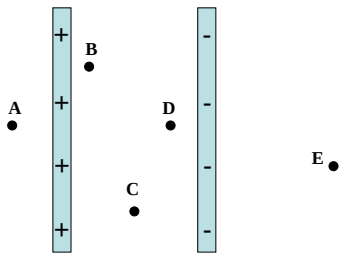
The arrangement of two electrodes shown in the figure is often called a "parallel-plate capacitor" and plays an important role in many electric circuits. One electrode has a charge $+Q$ while the other has a charge $-Q$. The plates are separated by a distance d. If the plates are large compared to their separation, you can assume them to be infinite in extent.



(a) Use Gauss's Law to find the field a distance d above an infinite sheet of charge.

(b) Using the result of (a), calculate the electric field to the left, to the right, and in between the plates. Draw arrows representing the electric field vectors in these regions.

(c) Rank in order, from largest to smallest, the forces F_A to F_E a proton would experience if placed at points A-E near this parallel plate capacitor.



Wolfson, Volume II, 2nd Edition, Problem 21.35

Wolfson, Volume II, 2nd Edition, Problem 21.54

Wolfson, Volume II, 2nd Edition, Problems 21.71, 72, and 73
(These three multiple choice questions go together. Please explain your answers or justify them with math.)